

The Basic Science of Climate Change



UNESCO-Course:
Climate Change Inside and Outside the Classroom



United Nations
Educational, Scientific and
Cultural Organization



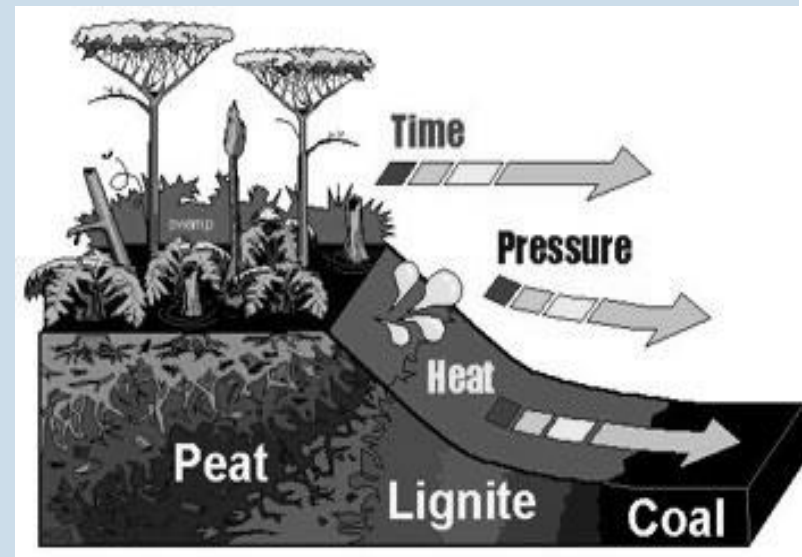
Module 1

VISIT...

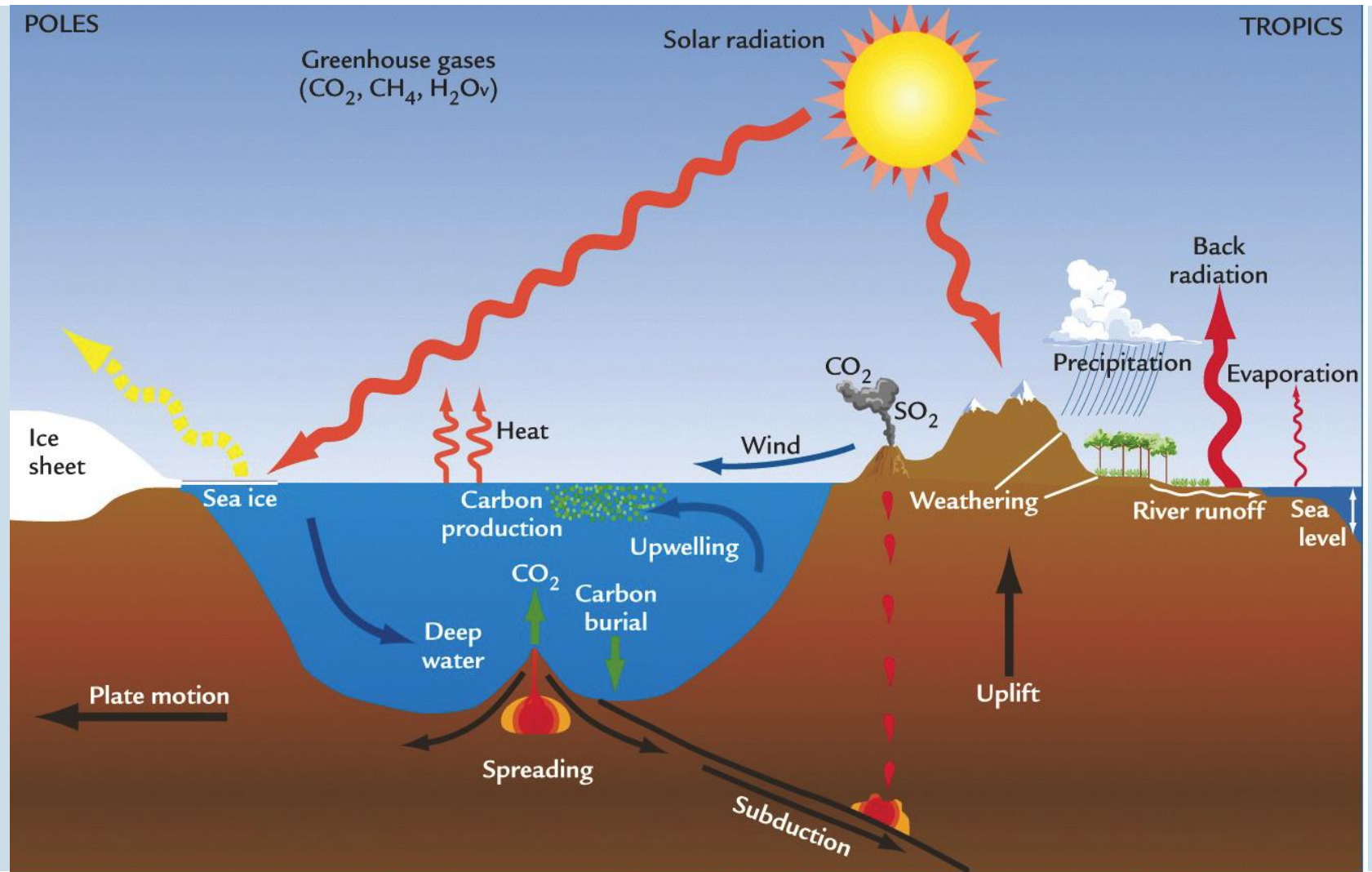
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What Are Carbon-based Fossil Fuels?

- Carbon-based molecules are the basic building blocks of all life forms (animals, plants)
- Fossil fuels were formed millions of years ago when prehistoric plants and animals died and sank to the bottom of the vast oceans and swamps.
- Under the intense pressure buried deep inside the earth, the rotting organic matter formed what is today mined as fossil fuels (coal, oil and natural gas).



Components of Earth's Atmosphere



Composition of the Atmosphere

- Thin layer of gases; 80% of the mass is contained below 10km of altitude
- Predominantly made up of nitrogen (78%) and oxygen (21%)
- Remaining 1% is made up of water vapour, carbon monoxide, carbon dioxide, neon, methane, krypton and ozone, some of which are so-called greenhouse gases

Atmosphere
80% of the atmosphere's mass lies within 10 km of the Earth's surface

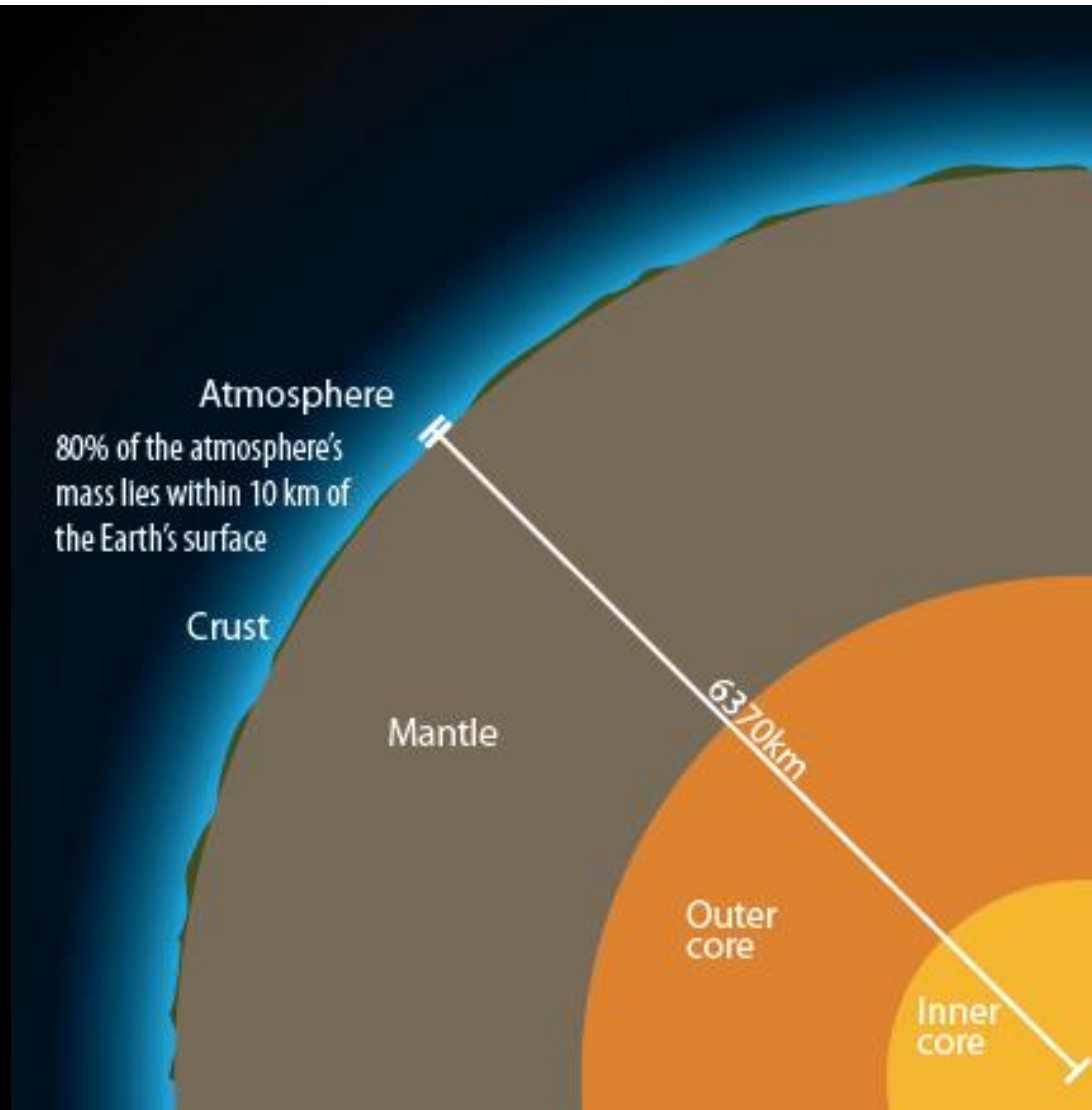
Crust

Mantle

Outer core

Inner core

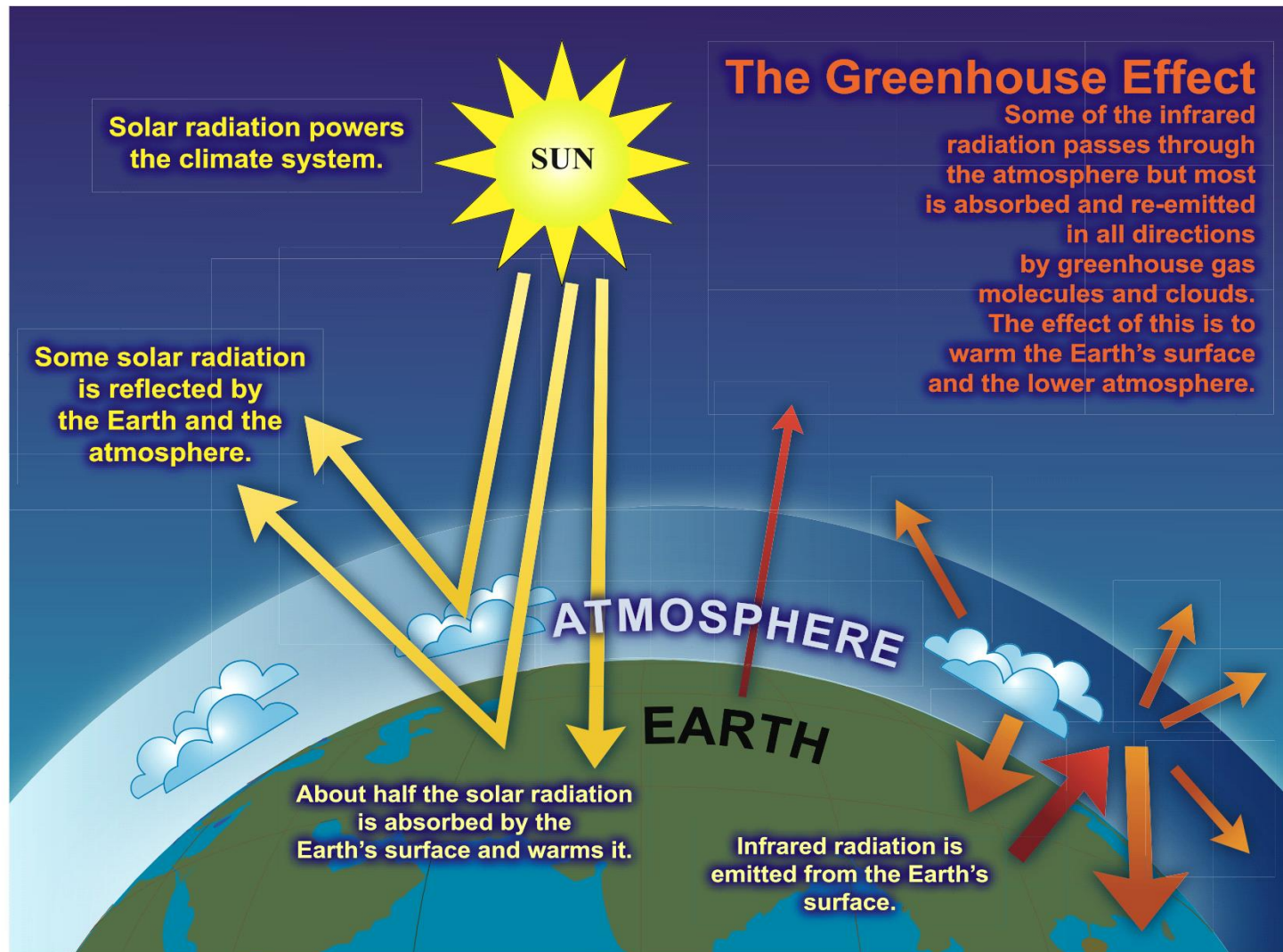
6370km



The Greenhouse Effect

- Weather is the temperature, precipitation and wind as they change hour by hour and day by day
- Climate is the average weather and the nature of its rhythmical variations that we experience over time
- The greenhouse effect is the natural process of the atmosphere letting in some of the energy we receive from the Sun and trapping it. For several thousands of years the atmosphere has been delicately balanced
- Human activities have led to an increase in greenhouse gases in the atmosphere causing an increased greenhouse effect and extra warming
- The main greenhouse gas responsible for recent climate change is carbon dioxide (CO₂). Others greenhouse gases produced from human activities include methane (CH₄) and nitrous oxide (N₂O).

The Greenhouse Effect Illustrated



Weather and Climate

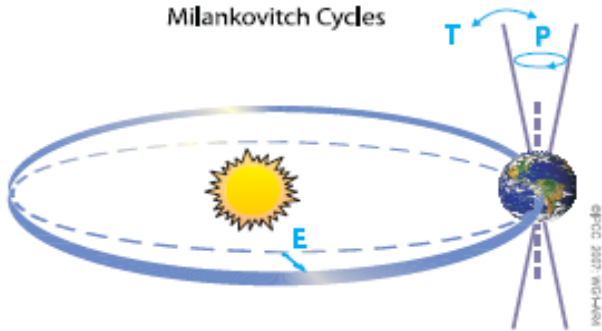
‘Weather’ describes current atmospheric conditions e.g. rainfall, temperature, wind speed, at a particular place and time

‘Climate’ is the average pattern of weather for a particular place over a long period of time – several decades



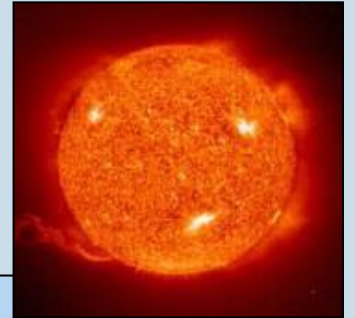
Factors Causing Changes In Climate

Milankovitch Cycles



**Changes in
Earth's orbit**

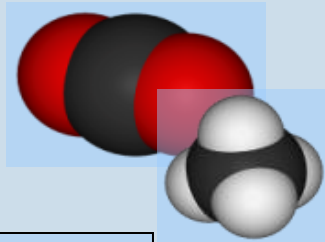
Solar changes



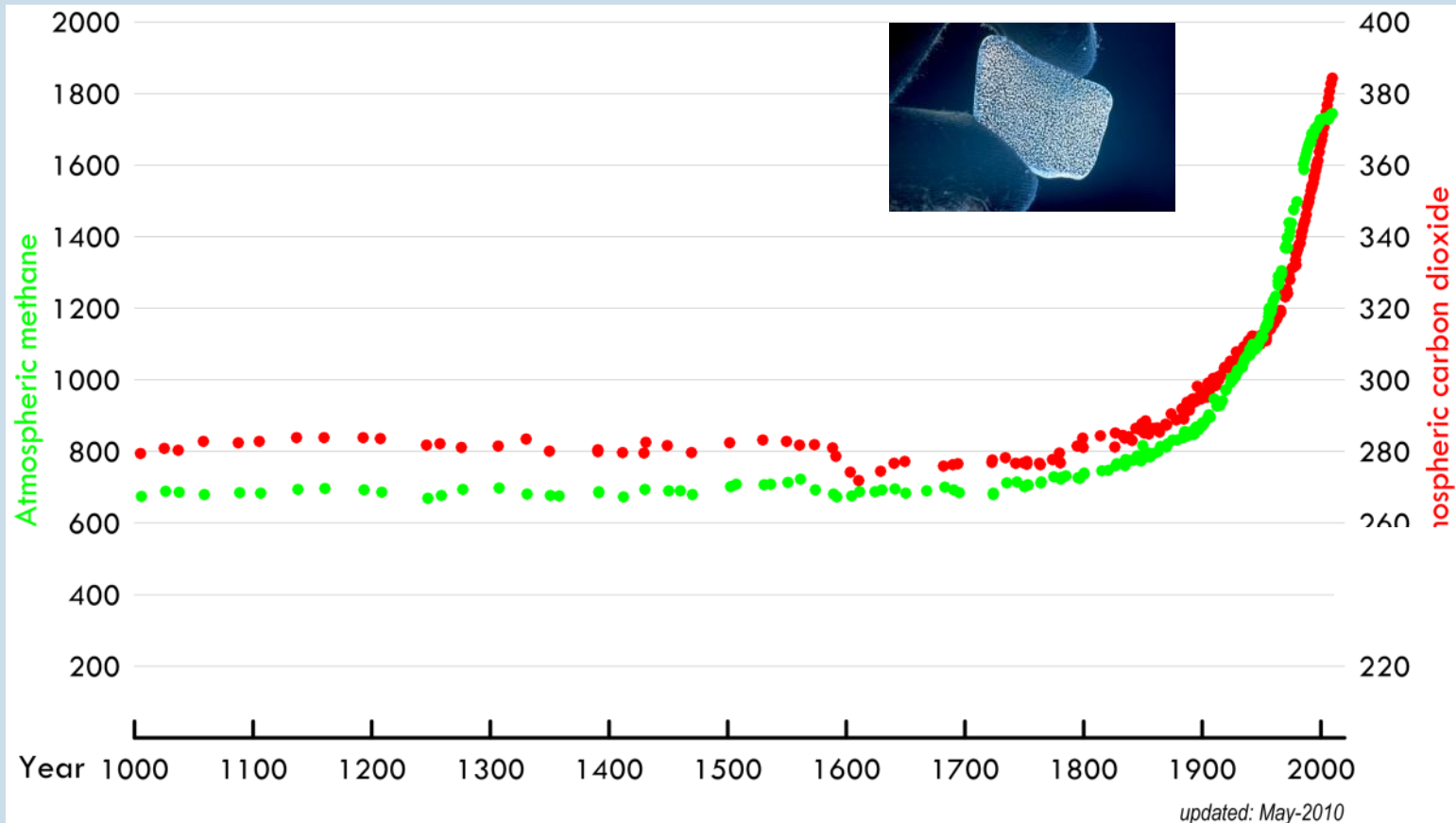
**Volcanic
eruptions**



**Changes in atmospheric
chemistry**

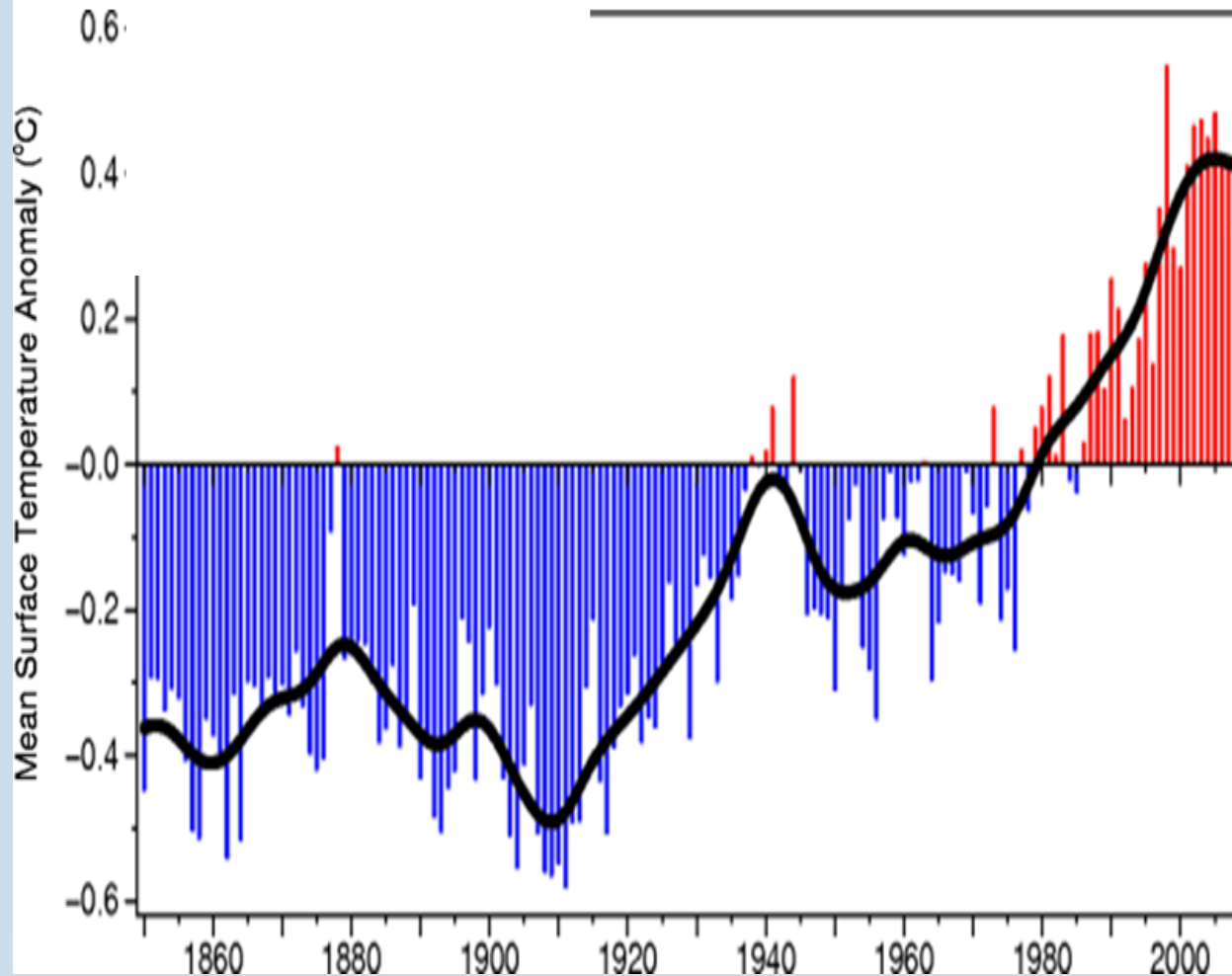


Changes in Atmospheric Carbon Dioxide and Methane Concentrations



Carbon dioxide concentrations are now greater than at any time during the past 650,000 years. The rate is accelerating.

Global Temperature Change

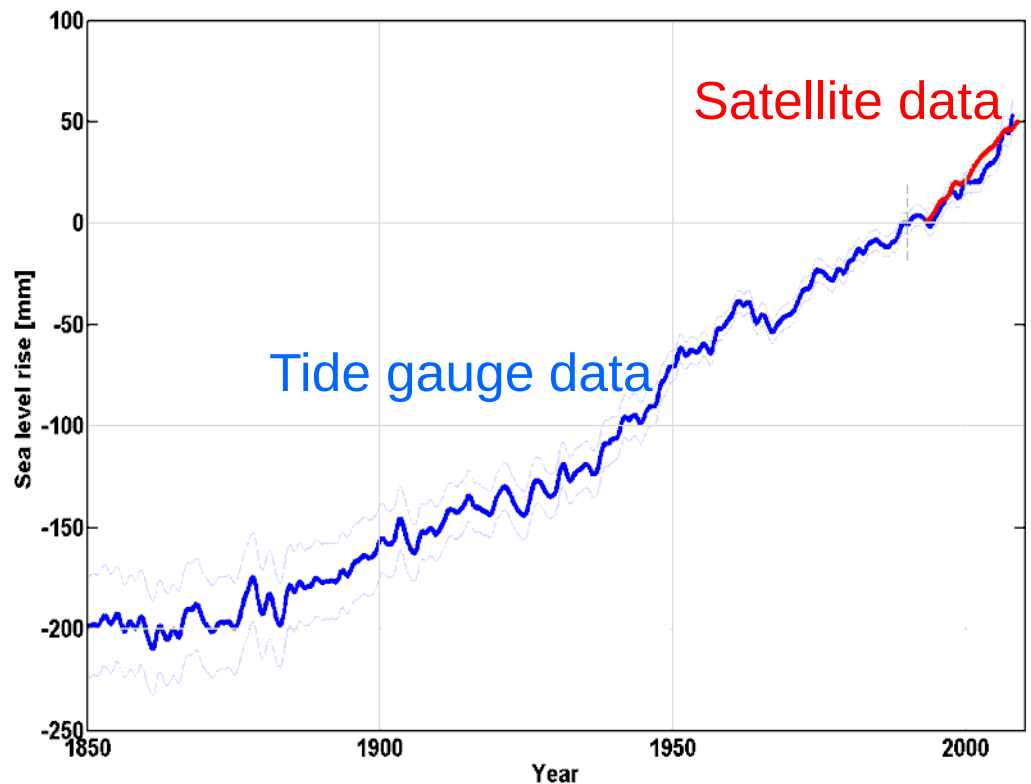


Source: Climatic Research Unit, UEA

**13 of the past
14 years are the
warmest ever
recorded**

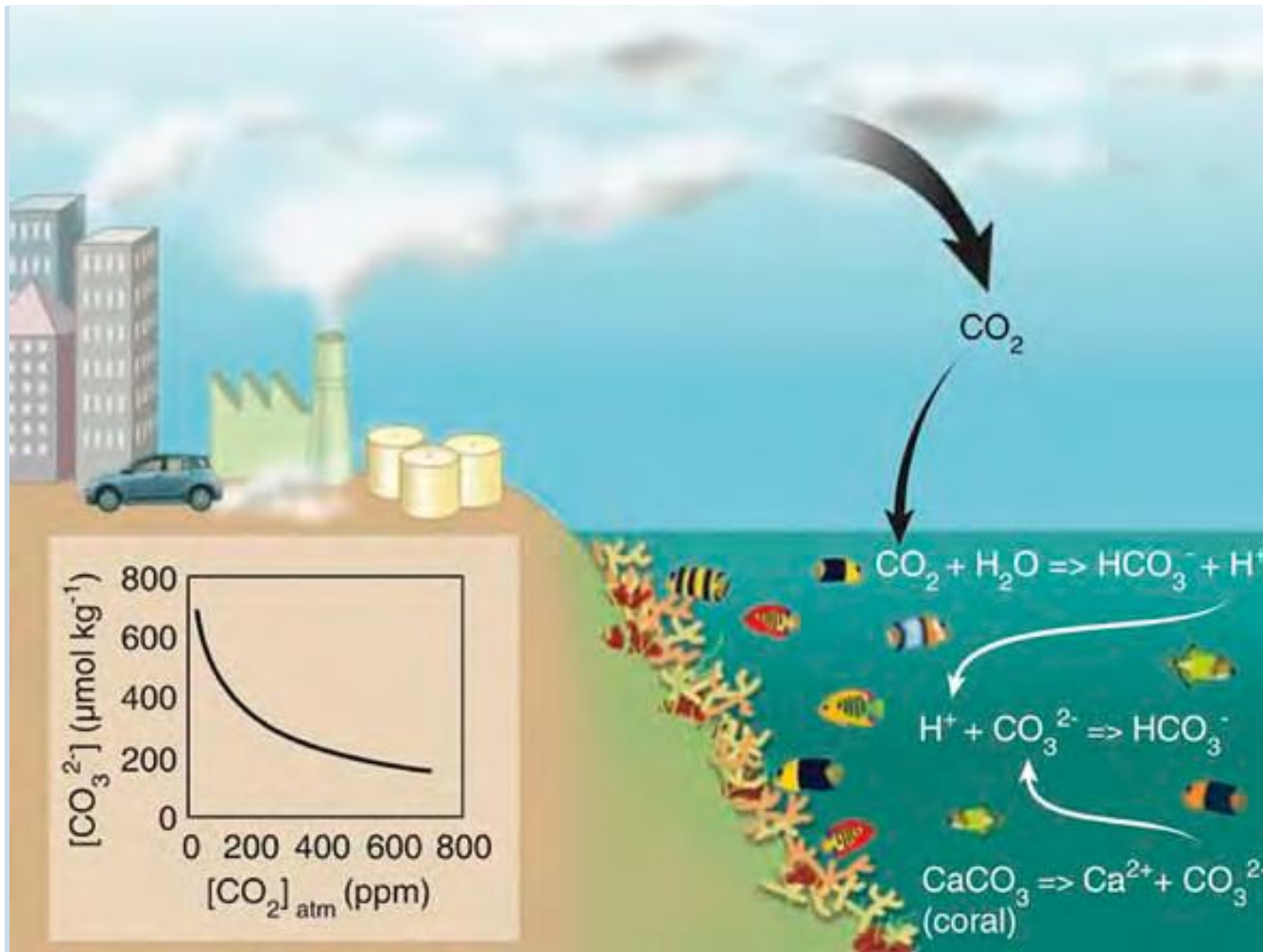
Sea Level Rise

- As water warms, it expands
- As ice-sheets and glaciers melt, they add to the ocean volume
- Both lead to sea-level rise (about 20 cm over last 100 years)



Updated from Church and White 2004

Ocean Acidification



Much of the CO₂ gets absorbed by the ocean –
GOOD for slowing global warming
– BAD for ocean acidification.